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ABSTRACT

This report describes a project to revise curriculum for the apprenticeship and other training programs preparing students for journeyman status in the electrical meter worker and station wirer trades. Products were a lineworker course information guide and revised copies of the electrical theory course for electrical meter worker and station wirer apprentices, an answer book for the electrical theory course, and electrical power station theory course. This final report also provides task listings for the three years of lineworkers apprenticeship training. Jobs, tasks, descriptions, and recommendations for method of instruction/introduction--school instruction, on-the-job instruction, and/or on-the-job training--are charted. (YLB)

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ED269644

FINAL REPORT
June 1986

Project: Curriculum Revision--Electrical Meterman and Station Wireman Apprentice

Encumbrance #: 20-650-710

Institution: Lane Community College
4000 E. 30th Avenue
Eugene, OR 97405

Project Director: Carl Horstrup

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

The purpose of this project was to provide revised up-to-date curriculum (specifically through ODE previously published books in the mid 1970 era) for the apprenticeship and other training programs preparing for journeyman status in the electrical meterman and station wireman trades. This entire project was a direct result of a request from the trade submitted to the Oregon Apprenticeship Related Training Advisory Committee. The original material was produced several years ago and therefore the necessity to update. Numerous individuals representing various utility apprenticeswhip committees and educational institutions around the state were hired to review and update these publications. A sampling of locations includes Sixes, Portland, Hermiston, Eugene, Springfield, Hillsboro, Corvallis and Tigard.

As the draft copies of the re-edited material were developed, they were continually reviewed prior to final printing.

The U.S. Department of Labor, Bureau of Apprenticeship and Training assisted in producing the user information material flyrs and the distribution of complimentary copies of the three final books to each individual Oregon Bureau of Labor and Industry apprenticeship office statewide. Thereby the individual field representatives will be able to furnish every respective utility apprenticeship committee within the state a copy for their use.

Products produced by this grant included the following:

Lineman Course Information Guide
1986 revised copies of:
- Electrical Theory Course for Electrical Meterman and Station Wireman Apprentices
- Answer Book for above
- Electrical Power Station Theory

The final budget report will be forwarded by the appropriate Lane Community College financial administrator with due respect to the posted time limitations.

CE 044496

LINEMAN APPRENTICESHIP

First Year

Job	Task	Description	SI	OJI	OJT
1.		Theory			
	A.	Explain Principles of Electricity I			
		1) Explain Electron Theory	X		
		2) Define some terms	X		
		3) Define Ohm's Law	X		
		4) Define Watt's Law	X		
	B.	Explain & Make Calculations with Respect to Single Phase Electric Circuits			
		1) Describe series circuits	X		
		2) Describe parallel circuits	X		
		3) Describe series and parallel circuits	X		
		4) Describe line loss	X		
	C.	Explain Electromagnetic Theory I			
		1) Describe natural magnets	X		
		2) Describe electromagnets	X		
		3) Explain electromagnetic induction (Lenz's Law & Faraday's Induction Law)	X		
	D.	Explain the Principles of AC/DC Generation and Power Factor			
		1) Explain AC generation	X		
		2) Explain DC generation	X		
		3) Explain 1Ø generation	X		
		4) Explain 3Ø, Y generation	X		
		5) Explain power factor	X		
2.		Transformers			
	A.	Explain Transformer Construction			
		1) Describe a transformer (types, nameplates, etc.)	X	X	X
		2) Describe parts & explain purpose of transformer	X		
		3) Explain relationship of kVA rating to construction	X		
		4) Explain additive and subtractive polarity	X		
	B.	Explain Transformer Operation I - Single Phase			
		1) Explain no load/load operation	X		
		2) Describe internal connections	X	X	
		3) Describe external connections	X	X	X
		4) Calculate load, current and voltage	X		
3.		System Operation			
	A.	Describe System Protection & Operation			
		1) Describe utility system & components	X	X	
		2) Describe overhead standards	X	X	
		3) Describe distribution layout	X		X
		4) Describe system protection	X	X	
	B.	Install Metering			
		1) Install self contained meters	X	X	X
		2) Describe & practice socket checks	X	X	X

	SI	OJI	OJT
4. Safety			
A. Explain and Demonstrate Safe Practices			
1) Describe limits of approach, protection for work, approved methods for stringing, aerial manlift equipment, working on poles and structures	X	X	X
2) Explain accident investigations, explain safety aspects of aerial manlift devices, live line work during inclement weather	X		
3) Workers' Compensation Board presentation	X		
4) Perform pole-top rescue	X	X	X
5) Perform bucket truck rescue	X	X	X
6) Describe safety rules for all employees	X	X	X
7) Describe procedure for first aid and accident	X	X	X
8) Describe personal protective equipment and tools	X	X	X
9) Explain safety meetings, safety committees	X		
10) Explain pre-jobs and tailboard meetings	X	X	X
5. Field Work (All First Year Field Work is Cold)			
A. Explain and Calculate Weights, Forces and Tensions			
1) Explain and calculate compressive force	X	X	
2) Explain and calculate guy tension	X	X	
3) Explain and calculate bisect tension	X		
B. Demonstrate Use of Rope and Rigging			
1) Explain use of handlines and rigging	X	X	X
2) Explain types of rope	X	X	X
3) Explain and calculate strength of rope	X		
4) Describe use and care of chains	X		
5) Explain safety factors of rope	X	X	X
6) Explain and demonstrate weaving rope blocks	X		
7) Describe and demonstrate snatch blocks rigging	X	X	X
8) Describe slings for rigging	X	X	X
9) Demonstrate and practice knots	X	X	X
10) Describe and practice polypropylene splices (eye, butt, long)	X	X	X
11) Describe and make powerbraid splices, eye, butt	X	X	
C. Demonstrate and Use Climbing Gear			
1) Inspect climbing gear			
2) Size and fit climbing gear			
3) Demonstrate care and maintenance of climbing gear	X	X	X
4) Sharpen spurs	X	X	X
D. Demonstrate Climbing Skills			
1) Demonstrate climbing procedures	X	X	X
2) Demonstrate climbing with confidence	X	X	X
3) Describe climbing checks	X	X	X
4) Describe climbing hazards	X	X	X
5) Explain climbing room allotment	X	X	X
E. Describe Pole Characteristics			
1) Explain classes and weight limitations	X	X	
2) Explain face, depth, gains	X	X	X
3) Explain pole checking	X	X	X
4) Demonstrate pole testing	X	X	X

		SI	OJI	OJT
	5) Explain pole treatments	X		
	6) Describe concrete poles	X	X	X
	7) Load, transport, unload and secure poles		X	X
F.	Explain Factors on Basic Hydraulics			
	1) Explain theory of hydraulics	X		
	2) Explain weight limitations	X	X	X
	3) Explain safety factors	X	X	X
	4) Explain checks and maintenance	X	X	X
	5) Explain and demonstrate hand signals	X	X	X
	6) Explain boom truck operation	X	X	X
	7) Explain bucket truck operation	X	X	X
G.	Strip Distribution Lines			
	1) Remove poles, wire crossarms, guys, hardware and insulators	X		X
H.	Set Poles			
	1) Set and relocate	X	X	X
	2) Explain utilities locations	X	X	
I.	Describe Metric System			
	1) Explain units of measure	X		X
	2) Explain measurements and conversions	X		X
J.	Explain Overhead Standards			
	1) Explain parts of standards book	X		X
	2) Explain basic hardware (insulation, pins, etc.)	X		X
	3) Explain important standards	X		X
K.	Describe Use of Guys			
	1) Describe strain insulator and fittings	X		X
	2) Describe guy steel - 5/16", 3/8"	X		X
	3) Describe some standards	X		X
	4) Describe pulling guys	X	X	X
	5) Describe dead-ending guys	X	X	X
	6) Describe sidewalk guys	X	X	X
	7) Describe push braces	X		
	8) Describe temporary guys	X	X	X
	9) Describe stake hold-fasts	X		X
	10) Describe types of anchors	X		X
	11) Demonstrate installation of screw anchor	X		X
L.	Describe Insulators			
	1) Describe some types	X		X
	2) Describe construction	X		
	3) Describe testing	X		
M.	Describe Uses of Ties			
	1) Use on primary	X	X	X
	2) Use on secondary	X	X	X
N.	Build Distribution Lines	X	X	X
O.	Install 10 Transformers	X	X	X
P.	Run Secondary	X	X	X

		SI	OJI	OJT
Q.	Explain or Describe Live-Line Tools			
	1) An introduction to and description of equipment for work on live-lines and conditions for work on live-lines	X		X
	2) Care for and clean live-line tools and rubber goods	X	X	X
	3) Test live-line tools and rubber goods	X		
	4) Identify live-line tools and rubber goods	X		
	5) Describe uses of live-line tools rubber goods, metal associated fittings	X		
	6) Check gear (tools, rigging)	X	X	
	7) Describe safe working loads	X	X	
	8) Demonstrate proper use of blocks	X		
	9) Describe live-line application of blocks	X		
R.	String Conductor			
	1) Describe effects of terrain	X		X
	2) Describe tools and rider poles	X		X
S.	Sag Conductor			
	1) Explain methods	X		X
	2) Practice calculations and use sag charts	X		
T.	Practice Staking			
	1) Use staking sheets	X		X
	2) Explain distribution symbols	X		X
	3) Do staking		X	X
U.	Explain Switching			
	1) Explain methods (10, 30 cutouts)	X	X	X
	2) Describe load break tool	X	X	X
V.	Describe 10 Reclosure			
	1) Explain operation and use	X	X	X
W.	Explain Wire Connections			
	1) Explain types	X	X	X
	2) Explain wire preparation	X	X	X
	3) Explain methods and problems	X	X	X
	4) Explain standards	X		
X.	Explain Characteristics of Conductor			
	1) Explain sizes, charts	X	X	X
	2) Explain vibration dampers	X		
	3) Explain armour rod	X		
	4) Explain radio interference	X		
Y.	Describe Grounding			
	1) Explain theory	X		
	2) Describe equipment, care and use	X	X	X
	3) Explain methods	X	X	X
Z.	Explain General Characteristics of URD Installations			
	1) Describe cables	X		
	2) Demonstrate terminations	X		
	3) Describe URD facilities	X		
	4) Demonstrate use of URD tools	X		

		SI	OJT	OJT
Aa	Describe and Demonstrate Chain Saw Safety			
	1) Describe tree climbing	X		
	2) Explain safety	X	X	X
Bb.	Describe and Practice Cutting-in Line Switches	X	X	X
Cc.	Handle and Care for Basic Tools			
	1) Use and care of bolt cutters	X		X
	2) Operate voltmeter	X	X	X
	3) Operate ammeter clip-on	X	X	X
	4) Operate multimeter	X		X
	5) Operate megger	X		X
	6) Operate rotation meter	X	X	X
	7) Describe thermocouple	X		
	8) Describe a Wheatstone brdge	X		
	9) Demonstrate use of phasing transformer	X		
	10) Use pole tongs	X		X
	11) Demonstrate use of compression tools	X	X	X
	12) Use an axe	X		X
	13) Use a brace and bit	X		X
	14) Use chisels	X		X
	15) Use files	X		X
	16) Use a hack saw	X		X
	17) Use a hand saw	X		X
	18) Use a tree trimmer	X		
	19) Use a brush trimmer	X		
	20) Use a tree pruner	X		
	21) Use goggles	X		X
	22) Use a switch hook stick	X		X
	23) Use a fire extinguisher	X		
	24) Use first aid equipment	X		
	25) Use grips (wire pulling)	X	X	X
	26) Use a ground rod driver	X		
	27) Use grounding equipment (sets)	X	X	X
	28) Use a chain hoist	X		X
	29) Use ladders	X		X
	30) Use pole jacks	X		
	31) Use reel jacks	X		
	32) Use peaveys and cant hooks	X		
	33) Use gin poles	X		
	34) Use wire rope	X		
	35) Use dynamometer	X		
	36) Use VHF radio	X		X
	37) Use stubbing equipment			X
Dd.	Perform Maintenance			
	1) Pole-top maintenance inspection		X	X
	2) Reset poles		X	X
	3) Straighten poles		X	X

LINEMAN APPRENTICESHIP
Second Year

Job	Task	Description	SI	OJI	OJT
1.	Theory				
	A.	Explain Principles of Electricity 11			
		1) Review Year 1 Theory	X	X	X
		2) Explain and calculate inductance	X		
		3) Explain and calculate capacitance	X		
		4) Explain and calculate reactance and reactive power	X		
		5) Explain and calculate power factor	X		
	B.	Explain Principles of Three-Phase AC Generation			
		1) Review Electromagnetic Theory 1	X		
		2) Review principales of AC/DC generation	X		
		3) Explain three-phase systems	X	X	X
		4) Explain wye connected system	X	X	
		5) Explain delta connected system	X	X	
2.	Transformers				
	A.	Explain Transformer Operation 11 Three-Phase			
		1) Review transformer theory	X	X	X
		2) Explain and do calculations for no-load/load operation (reactance in transformers)	X		
		3) Explain internal transformer connections	X	X	X
		4) Explain external transformer connections, Y systems			
	B.	Explain parallel temporary and permanent single phase	X	X	X
		1) Describe single and dual bushing transformers	X	X	X
		2) Describe and carry out load checks	X		
		3) Explain the primary and secondary off-load tap changer	X	X	X
	C.	Instrument Transformers			
		1) Describe potential transformer	X		
		2) Describe current transformer	X		
3.	System Operation				
	A.	Install Fuse Disconnects			
		1) Describe non-load and load break type cutouts	X	X	X
		2) Describe current ratings on switches	X	X	X
		3) Install fused cutouts and load break switch (gang operated). Describe difference between air-break and the fuse cutouts	X		X
	B.	Install Lightning Arresters			
		1) Types and application	X		
		2) Describe theory on rating	X		
		3) Install lightning arresters	X	X	X
	C.	Install Reclosers 30			
		1) Describe construction	X		
		2) Describe operation/use	X	X	
	D.	Install Sectionalizer			
		1) Describe construction	X		
		2) Describe operation/use	X	X	

		SI	OJI	OJT
E.	Explain Types of Street Lighting			
1)	Describe cascades	X		
2)	Describe series	X		
3)	Describe standard	X		X
4)	Interprets plans and makes up luminaires and supports		X	X
5)	Install luminaires and supports		X	X
6)	Install street lighting controls		X	X
4.	Safety			
A.	Explain and Demonstrate Safe Practices			
1)	Describe safety with respect to live-line tools	X	X	X
2)	Describe permits, safety grounding	X	X	X
3)	Describe guarding work site, cones, etc.	X	X	X
4)	Explain requirements of linemen's climbing gear	X		
5)	Explain Workers' Compensation Board rules	X	X	X
6)	Perform pole-top rescue	X	X	X
7)	Perform bucket truck rescue	X	X	X
8)	Explain and describe plastic cover-up	X	X	X
9)	Explain live work on #6 copper and smaller	X	X	X
10)	Explain testing of poles and temporary support	X	X	X
11)	Explain accident investigation	X	X	X
12)	Explain live-line work during inclement weather	X	X	X
13)	Explain live-line equipment testing procedures	X		
14)	Explain precautions in using 4' live-line sticks and gripall	X		
5.	Field work (Hot)			
A.	Explain and Demonstrate Rope Blocks			
1)	Review Year (Home Study)	X	X	X
2)	Explain mechanical advantage	X		
3)	Explain and demonstrate live-line applications	X		X
4)	Explain and practice handling and care	X		X
B.	Explain and Calculate Weights, Forces and Tensions			
1)	Explain and calculate conductor weight	X		
2)	Explain and calculate conductor tension	X		
3)	Explain and calculate forces on dead-end pole	X		
4)	Explain and calculate bisect tension	X		
C.	Performing Rigging Calculations			
1)	Calculate safe working loads	X		
D.	Describe Live Tools			
1)	Explain characteristics and applications	X	X	X
2)	Explain and practice care and cleaning	X	X	X
E.	Construct and Maintain URD Services			
1)	Explain historical development and cable design	X		
2)	Describe basic tools	X		
3)	Describe common termonators	X		X
4)	Construct terminations	X		X
5)	Describe common splice	X		
6)	Construct splices	X		X
7)	Describe system grounds	X		
8)	Identify and explain secondary connections	X		
9)	Explain ferroresonance	X		

		SI	OJI	OJT
F.	Handle and Care for Basic Tools			
	1) Operate phasing sticks	X		X
	2) Describe use of vent fans	X		
	3) Describe use of gas detector	X		
G.	Make Basic Knots and Splices			
	1) Review Year 1 (Home Study)		X	
	2) Make knots	X	X	X
	3) Make splices	X	X	X
H.	Describe and Explain Use of Four kV Rubber Protective Equipment			
	1) Describe rubber goods	X	X	X
	2) Explain inspection and electrical testing	X	X	X
	3) Explain care and cleaning	X	X	X
	4) Explain storage	X	X	X
	5) Explain uses	X	X	X
I.	Describe and Use Auxiliary Live-Line Equipment			
	1) Use saddles	X		
	2) Use lever lifts	X		
J.	Tie and Untie Conductors			
	1) Tie Conductors	X	X	X
	2) Untie conductors	X	X	X
K.	Describe and Install Pole Platforms			
	1) Explain characteristics and applications	X		
	2) Install Platform	X	X	X
	3) Dismantle platform	X	X	X
	4) Explain care and cleaning	X		
L.	Raise 10 Conductor by Single Pole Lift	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install lifting wire tong, saddles and rope blocks			
	4) Untie and raise conductor and make changeout			
	5) Lower conductor and retie			
	6) Remove lifting wire tong, saddles and rope blocks			
M.	Raise 10 Conductor by Two Pole Lift	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install lifting wire tong, control wire tong and saddles			
	4) Untie and raise conductor and make changeout			
	5) Lower conductor and retie			
	6) Remobe lifting wire tong, control wire tong and saddles			
N.	Install 25 kV Floating Dead-Ends Using Bucket Truck	X	X	X
	1) Explain pupose and application (Proper tools)			
	2) Position bucket truck			

		SI	OJI	OJT
	3) Install grips, live-line hoists and jumper (if necessary)			
	4) Cut conductor, install straightline clamps and insulators			
	5) Release and remove live-line hoist and grips			
	6) Install permanent jump (if necessary) and remove temporary jumber			
O.	Explain and Practice Ampacting	X	X	X
	1) Explain purpose and application			
	2) Establish work position (e.g. pole platform bucket)			
	3) Install riser with ampact tool			
	4) Install jumber from cutout to stirrup and energize transformer			
P.	Change Over Dead-End Sleeving Conductor	X	X	X
	1) Explain purpose and application			
	2) Establish work position (e.g. pole platform bucket)			
	3) Install comalong geip, sling and live-line hoist or rope blocks and snatch block			
	4) Cut conductor, install sleeve with live-line Y-35			
	5) Remove live-line hoist or blocks, sling and comalong grip			
Q.	Change Dead-End Clamp (Straight Line Clamp)	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install comalong grip, sling and live-line hoist or rope blocks and snatch block			
	4) Change dead-end clamp			
	5) Remove live-line hoist and blocks, sling and comalong grip			
R.	Change Dead-End Insulators	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install comalong grip, sling and live-line hoist or rope blocks and snatch block			
	4) Change dead-end insulators			
	5) Remove live-line hoist and blocks, sling and grip			
S.	Raise Three-Phase Tangent with Lever Lift	X	X	X
	1) Purpose and application			
	2) Establish work position			
	3) Install lifting wire tongs, control wire tongs, crossarm saddles and lever lifts			
	4) Untie and raise conductors and make changeout			
	5) Lower and retie conductors and remove equipment			

T.	Raise Three-Phase Tangent with Pole Saddles 1) Explain purpose and application 2) Establish work position 3) Install saddles, lifting wire tongs, control wire tongs, rope blocks and crossarm guard 4) Untie and raise conductor and make changeout 5) Lower and retie conductor and rmove equipment	X	X	X
U.	Install Three-Phase Deflection Medium Angle (alternate job) 1) Explain purpose and application 2) Establish work position 3) Install temporary crossarm, pole saddles, crossarm saddles, wire tongs (lifting and control), rope blocks, crossarm changeout 4) Untie and raise conductor and make changeout 5) Lower and retie conductors and remove equipment	X	X	X
V.	Install Three-Phase Deflection Heavy Angle 1) Explain purpose and application 2) Establish work position 3) Install temporary crossarm, pole saddles, crossarm saddles, wire tongs (lifting), link sticks, rope blocks and crossarm guard 4) Untie and raise conductor and make changeout 5) Lower and untie conductors and remove changeout	X	X	X
W.	Change 4 kV Crossarm with Auxiliary Arm and Mast Assembly 1) Explain purpose and application 2) Establish work position 3) Install rubber protective gear, auxiliary arm and mast assembly, 2 saddles 4) Untie and lift phases to auxiliary arm 5) Change arms 6) Lower phases, retie and remove equipment and rubber protective gear	X	X	X
X.	Change Three-Phase Arm to Higher Pole Using Bucket Truck Jib Method 1) Explain purpose and application 2) Establish work position 3) Install new crossarm assembly 4) Secrure guarded phase into live-line jib assembly 5) Untie and raise conductor to new insulator and retie (repeat) 6) Remove old crossarm and pole (B.C. Tel)	X	X	X

		SI	OJI	OJT
Y.	Lay Out Secondary Services			
	1) Explain types of conductor, capacity, span, length, clearances, etc.		X	X
	2) Explain types of anchors and depth of setting		X	X
	3) Disconnect/reconnect secondary service at the pole		X	X
Z.	Install Three-Phase Transformer(s) Pole and Pad Mount			
	1) Install 3Ø transformer pole mount	X	X	X
	2) Install 3Ø transformer pad mount	X	X	X
Aa.	Perform Maintenance			
	1) Locate and repair fault on overhead conductors		X	X
	2) Locate, dagnose and rectify overhead and underground service faults (secondary)	X	X	X

LINEMAN APPRENTICESHIP
Third year

Job	Task	Discription	SI	OJI	OJT
1.	Theory				
	A.	Explain principles of Electricity			
		1) Review principles of electricity Year 1	X	X	X
		2) Review principles of electricity Year 11	X	X	X
		3) Explain power factor connection	X		
	B.	Explain and Make Calculations with Respect to Electric Circuits			
		1) Review single phase circuits	X	X	X
		2) Explain loss and voltage lag on a 3Ø circuit	X		
	C.	Explain Electromagnetic Theory 111			
		1) Review Electromagnetic Theory 1	X		
	D.	Explain Principles of AC/DC Generation			
		1) Review principles of AC/DC Generation 1	X		
		2) Review principlew of AC/DC Generation 11	X		
2.	Transformers				
	A.	Transformer Operation 111			
		1) Review Transformer construction (Home Study)	X	X	X
		2) Explain connections of additive and subtractive transformers	X		
	B.	Transformer Operation 111			
		1) Review Transformer Operation (Home Study)	X	X	X
		2) Describe parallel temporary three-phase	X		
		3) Open Y- Open emergency connection	X		
3.	System Operation				
	A.	Describe System Protection and Operation			
		1) Review description of utility system and protection Year 1	X		X
		2) Explain protection theory and device selection	X		
	B	Operate Fuse Disconnects			
		1) Operate fuse cutouts		X	X
		2) Operate air-break switch		X	X
	C.	Explain Metering 111			
		1) Explain transformer type metering (services over 200 amp)	X		
	D.	Describe Voltage Regulators			
		1) Describe construction	X		
		2) Describe and demonstrate switching	X		
		3) Explain operation	X	X	
		4) Install voltage regulators and associated switching equipment into service	X		
	E.	Explain and Describe Capacitors			
		1) Describe construction and operation	X		
		2) Demonstrate switching and grounding	X	X	X
		3) Install capacitors and associated switching equipment	X	X	X

		SI	OJI	OJT
F.	Explain Protection Coordination			
1)	Explain protection theory	X		
2)	Explain device selection (sectionalizer)	X	X	
4.	Safety			
A.	Safety			
1)	Explain safety with respect to operation and maintenance	X		X
2)	Describe permits, safety grounding	X	X	X
3)	Describe guarding work site	X	X	X
4)	AFT "400" remaining sections to be covered	X		
5)	Live-line bulletin - remaining sections to be covered	X		
6)	Explain Workers' Compensation Board rules	X	X	X
7)	Perform pole-top rescue	X	X	X
8)	Perform bucket truck rescue	X	X	X
5.	Field (Hot)			
A.	Demonstrate Use of Rope Blocks (Live-Line)			
1)	Review (Home Study)		X	
2)	Explain handling and care (review)	X		X
B.	Calculate Weights, Forces and Tensions			
1)	Review	X	X	X
C.	Perform Rigging Calculations			
1)	Review rigging (Home Study)	X	X	X
2)	Calculate rigging forces	X		
3)	Calculate forces to rigging	X		
D.	Underground Services			
1)	Install underground service conductors (ducted). Inspect cable sheath for damage	X		X
2)	Install open wire bus conductor	X		X
3)	Clean conduit for primary ducted cable	X		X
4)	Rack and train ducted cables	X		X
5)	Install manhole rigging to pull cables in conduit	X		X
6)	Select and install pulling lines	X	X	X
7)	Lubricate and fill in ducted cable	X	X	X
8)	Cut, strip clean, join and re-insulate PVC cable	X	X	X
9)	Cut and cap cables	X	X	X
10)	Construct moulded joints and terminator	X	X	X
11)	Locate and repair underground cables (fault finding)	X	X	X
12)	Operate transformer URD switch gear	X	X	X
13)	Operate load braeak and non load break terminators with live-line tools	X	X	X
14)	Operate load break switches with live-line tools	X	X	X
15)	Perform cable spiking	X	X	X
16)	Perform E.S.P. potential testing	X	X	X

		SI	OJI	OJT
E.	Change 138 kV Dead-End Insulator	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install hot and cold yoke and cradle			
	4) Break dead-end insulators with insulator forks			
	5) Reconnect dead-end insulators			
	6) Remove live-line rigging			
F.	Perform a 138 kV "H" Frame Timber Change	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install lever lifts, lifting wire tongs, link sticks and rope blocks			
	4) Unclamp and fan out outside conductors and unclamp and lower centre conductor and remove insulator string			
	5) Install slings and rope blocks to timber and remove timber			
	6) Install new timber and insulators. Reclamp conductors and remove equipment			
G.	Perform 60 kV Wishbone Insulator Change	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install 2 lever lifts, 3 lifting wire tongs, 3 control wire tongs, pole saddles, slings and blocks			
	4) Unclamp conductor and fan out			
	5) Change out insulators. Reclamp conductors and remove equipment			
H.	Perform 60 kV Three-Phase Tangent Crossarm Change	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install 2 lever lifts, 3 lifting wire tongs, 3 control wire tongs, pole saddles, slings and blocks			
	4) Unclamp conductor and fan out			
	5) Change out crossarm. Reclamp conductors and remove equipment			
I.	Change 60 kV Dead-End Insulator Using Bucke t Truck	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install slings, blocks, live-line grip, link stick (or live-line hoist)			
	4) Unclamp conductor, change insulator. Reclamp and remove equipment			
J.	Install 25 kV Floating Dead-Ends Using Pole Platform	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install comalong grips, blocks snatch block and jumper (if necessary)			
	4) Install straight line clamps and insulators			
	5) Release and remove blocksand grips			

		SI	OJI	OJT
K.	Perform 25 kV Tension Stringing	X	X	X
	1) Explain purpose and application			
	2) Establish work position			
	3) Install extension auxiliary arm, fan out conductor Install traveller, "P" line and srring new conductor			
	4) Dead-end sag and tie to insulators and remove equipment			
L.	Perform 25 kV Three-Phase Tangent Crossarm Change with Bucket and Boom Truck	X	X	X
	1) Explain purpose and application			
	2) Establish work position with airial device			
	3) Install boom mounted auxiliary arm and crossarm gaurd			
	4) Untie conductor and lift			
	5) Change out crossarm			
	6) Lower conductor, retie and remove equipment			